THE MODEL ENGINEER

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Smoke Rings

Model Engineering Scores Again

STILL another acknowledgment of the technical value of skill and knowledge gained through model engineering reaches me from a member of a well-known club. Writing to tell me of his appointment as assistant works manager to an engineering firm in the Midlands, he says :—" May I state that once again my model making has played a big part in assisting me in my work, and, what is more, in obtaining the approval of my directors."

A Soldier Looks Ahead

AN officer reader who has contributed some beautiful models to " M.E." Exhibitions in pre-war years writes me in regard to locomotive drawings. He says, "I want a change from concentrated soldiering, so propose to try planning a 2½-in. gauge loco. I must have something to look forward to. After 2½ years on H.Q. here, I'd like an hour or two a day thinking of something else except my job." My correspondent has been on duty in an exceptionally lively spot, and I can understand his desire to divert his mind occasionally from the frequent visitation of bombs and shells.

Production Help Wanted

I HAVE received two enquiries for urgent production assistance such as some of our readers may be able to give personally or in their home workshops. The first is addressed to those who live in the West London or Middlesex areas, who would be willing to turn small parts such as gear blanks, and to centre and rough turn, or even finish, spindle work. Materials and detailed drawings would be supplied, and payment would be by mutual arrangement. The second enquiry is of interest to those living in the North London or outlying district. It calls for the making of occasional special mechanical devices connected with machine tool work, and also for temporary assistance during rush periods in the firm's drawing office. It is thought that retired engineers who have had drawing office experience might be willing to help in this way. I should be pleased to receive replies to either of these enquiries, and to forward the names and addresses of those who are willing to help. Although I already have a number of names on my register of home workshops, it may be that some of these are no longer in a position to offer further service, and in order to keep my register up-to-date I should be glad to hear even from those who have already sent in their names, if they are still able to co-operate in a practical degree.

Award for an Invention

THE Council of the Royal Society of Arts have awarded the annual Thomas Gray Memorial Trust Prize of £50 for an invention advancing the science or practice of navigation, to Mr. T. E. Metcalfe, O.B.E., of Windsor, for the Seaman's Protective Suit devised by him. This suit, which when not in use folds into a compact bundle, weighing about 3 lb., forms a complete covering of water- and wind-proof material to be put on when a shipwrecked person reaches a lifeboat or raft. It is being provided by the Ministry of War Transport on a wide scale, and has already saved many men from death by exposure to the elements.

Our Division Plate Competition

I AM pleased to say that this competition has aroused a widespread interest, and I have received a number of entries of varying types of solution of the problem. As it will take some little time to give these the careful and critical consideration they deserve, I would ask the competitors for their kind patience until I am in a position to announce the result.

Percival Marshall

A $3\frac{1}{2}$-in. Gauge *MAID-OF-ALL-SORTS*

By "L.B.S.C."

SOME years ago I described in these notes, how to build a Southern 4-4-0 of the "D. 15" class, as originally designed by Mr. Drummond and rebuilt by Mr. Urie; the initials U-D gave it the nickname of the "Dairymaid," and dimensions were given for both $2\frac{1}{2}$-in. and $3\frac{1}{2}$-in. gauges. Quite a number of these engines were built, and to the best of my knowledge and belief they were all successful; but whilst some builders liked the general outline and proportions of the engine, they did not like inside cylinders and motion, and so followed their own inclination and put them outside. Incidentally, the wheel spacing is not exactly ideal for an outside-cylinder engine with the usual arrangement of valves on top, and outside valve-gear; however, that didn't deter our friends who wanted a spot of originality, in the slightest, and I gave many "'ints and tipses" by direct correspondence to those builders who were incorporating their own ideas. Among the engines which have been completed, is that shown in the illustration, and she is the handiwork of Mr. A. Jones.

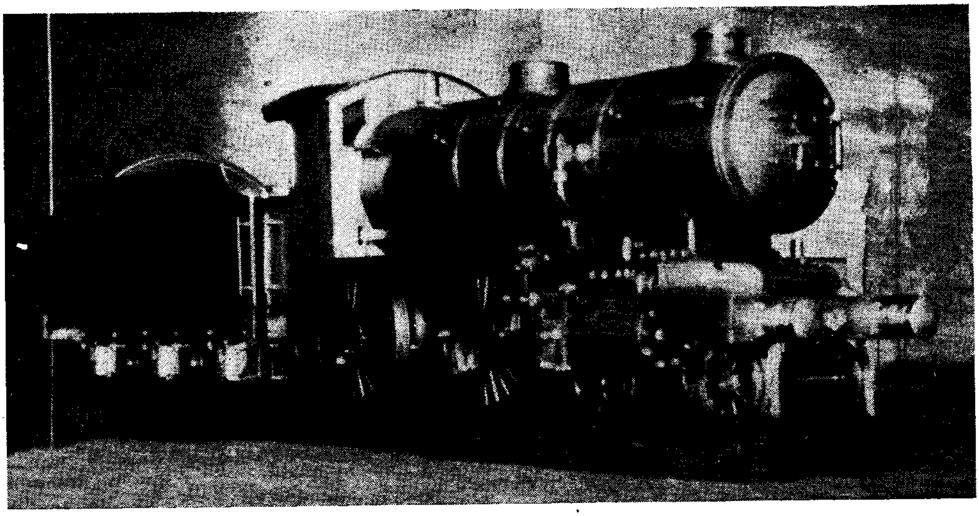
Mr. Jones chose the $3\frac{1}{2}$-in. gauge size as being less fiddling than $2\frac{1}{2}$-in., especially on the valve gear work, and he has spent a great deal of time and patience in producing a locomotive that is a good worker, the job having occupied his spare time for some years. However, everything comes to an end at last, as even Adolf and Co. will find out, and the reproduced photo. shows the engine finished, all except painting. If she had a lower cab and boiler mountings, she would not be unlike a Southern "V" class. Regarding construction, Mr. Jones says he used hexagon-headed screws and bolts everywhere, whether in sight or not; and the appearance of the heads, he thinks, well repays the trouble taken. The cross-heads are cut from one solid piece, the recess for the little-end being milled out. All the valve-gear parts are made from key-steel, with hardened eyes and silver-steel pins. Our friend says he had to machine up four cylinders altogether, as he had two faulty castings, a ticklish job on an old and worn $4\frac{1}{2}$-in. pedal-operated lathe, on which he also made all the small oddments, including hand-rail knobs turned from 7/32-in. nickel-bronze. A mechanical lubricator is fitted behind the front buffer beam.

The boiler is both riveted and silver-soldered at all joints and seams, and has been tested by water pressure to 250 lb., and steam to 125 lb., although the required working pressure is only 80 lb. It is fed by an eccentric-driven pump, and the driving axle and pump eccentric are in one piece, being turned from $1\frac{1}{4}$-in. steel bar. There is also a hand pump in the tender, which, like the rest of the plate work, is made from 1/16-in. sheet brass. It has working leaf springs. All the buffer sockets were turned from square-section brass rod; and as Mr. Jones could not get any half-round wire for the cab and tender beading, he cut strips of 1/16-in. sheet brass and filed them to half-round section—a job, I should imagine, well calculated to tax anybody's patience and damp their enthusiasm!

Performance is good. The only available passenger car is a rough makeshift affair with plain brass bearings; but with two adults on it, totalling 23 stone of "live meat," she gets away quite easily with 50 lb. showing on the steam gauge. The present track is very short, and the engine has no chance to show her paces, but our friend says he hopes ere the summer has passed, to have a longer line, and meantime he is well satisfied with the result of his long-drawn-out labours.

The Efficiency of Old-timers

Since my comment on Mr. Willoughby's article appeared, in which I took up the cudgels in defence of Mr. James Stirling's 4-4-0's of the old South Eastern Railway, some letters have come to hand on this subject; and as they are mostly from old enginemen, the opinions and remarks carry the weight of practical experience. An old G.S.W. man says that the Smellie 4-4-0 engines to which I specifically referred, were among the best locomotives that line ever had. Smellie designed them on the lines of their Stirling predecessors, and they were built at Kilmarnock, between 1886 and 1889. They could run "like a deer," and could handle anything put behind them, without making a fuss about it. When new, they worked between Glasgow and Carlisle on all the important trains; and later, when replaced on that section by larger engines, did remarkably good work on the Stranraer and other hilly roads. Even when climbing long banks "all out" with a tidy load, their "bark" was not excessive, and they were never short of steam. The old driver added that Smellie was taught his job by James Stirling, and it was not likely that the "teacher" would put inferior engines on the



A 3½-in. gauge "Dairymaid," by Mr. A. Jones.

South Eastern, to those his "pupil" put on the G.S.W., an opinion with which your humble servant agrees. "Churchwardian" states that the cylinders of the *ex*-S.E.R. F1's were reduced to 18 in. diameter when reboilered by Mr. Wainwright; but the new boilers carried a higher pressure, which explains matters. He also says that the original valve gear and setting remains unaltered, which is correct as far as my own knowledge goes, and speaks volumes for its efficiency in these days of "super-gears"; and another correspondent who has had experience of the Stirling engines transferred from the Southern to the L.M.S., says they are making the latter company's enginemen "sit up and take notice," by the way they do the job. Talk about "life in the old dogs yet——!" But it is no surprise to anyone familiar with both the Stirling South Easterns and Billinton's Brighton 4-4-0's, that the former are proving the longer-lived; personally, I wonder the latter have lasted as long as they have! It is only excellent maintenance that has kept them on the road, or they would long since have fulfilled the prophecy of the old Scottish locomotive man who attended them on delivery way back in 1901.

Several other types of locomotives were also "mentioned in despatches," and details given of their work, but I need not set them all out here; suffice it to say that the impression held in some quarters, viz.: that the locomotive superintendents who held office during the latter part of the last century, did not know their job properly, and designed engines whose proportions were "all wrong," is entirely erroneous. My own personal opinion is, that if they had been conversant with, and applied to their engines such refinements as, for example, superheating and mechanical lubication, and run at higher pressures, the general efficiency of most of the 50 year-olds would not have fallen short of the engines of today. As I mentioned in the comment first referred to, the Stirling drivers of the South Eastern voted for higher pressures; and proof that they were right, is forthcoming from a correspondent who points out that the Johnson 4-4-0's on the Midland, which came out in 1884, had 19 in. by 26 in. cylinders and 140 lb. pressure, same as the Stirlings; but when they were rebuilt, with a boiler having the same size firebox and grate, but with a few more tubes and carrying 160 lb. pressure, the extra pressure made all the difference in the world to their performance, as the drivers were able to notch up to an earlier cut-off, and the coal and water consumption fell in proportion, whilst the acceleration was much improved.

Are Coned Wheel Treads Necessary on Small Engines?

A follower of these notes who raises the above question, says he was prompted by the result of some recent experiments carried out on the L.M.S. to find out the cause of side oscillation of rolling stock. Any platelayer will tell you that on certain stretches of straight line, the insides of the rail heads become "wavy" through the wheels of various types of rolling stock wandering about on top of the rail. It is especially noticeable on electric lines, where there is a great deal of weight at a low centre of

gravity, as in the bogies of motor coaches on multiple-unit sets. Travellers on the Southern, for instance, have noticed it on the line across Wandsworth Common, where bright and dull patches can be seen alternating along the full length of the rail head, showing where the flanges make contact.

On the L.M.S., a coach was fitted with a light underneath, near rail level, and a periscope, by which it was possible to take a cinematograph picture of the lateral movement of a wheel, whilst the train was running; and various contours of flanges and tyres were tried, varying from the standard 1 in 20 taper, to a wheel with a perfectly cylindrical tread.

The latter gave the best results of all as far as non-oscillation was concerned, but the drawback was that when the flange touched the railhead, it stayed there until the train went around a curve or through points and crossings, resulting in excessive flange wear. To overcome this, a very slight taper was given to the tread, a cone of 1 in 100 being found to give the best all-round results, and this has now been adopted as standard for all main-line stock. These experiments were described by Mr. W. A. Stanier, the C.M.E., in his Presidential Address to the Institution of Mechanical Engineers.

As our little locomotives have coned treads, and in the smaller sizes we do not fit any side-control springs to bogies and pony trucks, the question now arises, do the engines suffer from excessive side oscillation, and is that the cause of the many derailments which take place on the majority of small lines, even simple up-and-down straights? On my own line, I am very free from this sort of thing. Owing to weather conditions, the road isn't exactly as level as a billiard-table, and "warpalisation," as the late Dan Leno would have said, of the longitudinals, has properly upset the symmetry of the curves; whilst post subsidence in made-up ground at the entry of the south curve, has "put paid" to the transition portion, so that we now come off the straight line on to a curve with hardly any easing. Despite this, *Tugboat Annie*, which has the highest centre of gravity of any of my engines, and therefore inclined to "lean over," scoots around the curves at a speed equivalent to 140 m.p.h. in full size, and does not run off the road; whilst on the straight, she is as direct as an arrow. This may, of course, be partly due to her great length, as old *Ayesha*, a much shorter engine, sometimes oscillates visibly on the straight, although she keeps the road at the same speed. But here again, her big cylinders may be setting up a shouldering action, so no blame may definitely be attached to either the wheel contours or length of rigid wheelbase.

I have never bothered to measure the exact taper of the cone, but I now usually set the slide-rest just the weeniest bit out of parallel, when turning treads, and use a round-nose tool which gives a fairly big radius at the root of the flange, as in American practice. I find that wheels turned thus, run with less friction on curves, and do not wear the railhead to any great extent; whereas the ordinary flange as found on commercially-built engines, often has a narrow radius at the root, and allows the flange to bite into the railhead, besides causing excessive flange friction. I don't think it matters much whether we turn out treads 1 in 20, 1 in 100, or cylindrical, so long as the edge is chamfered slightly, the wheels mounted truly on their axles, and set correctly to gauge.

"Molly" on Gauge "1"

When introducing "Molly," I mentioned that she would make a dinky little engine built half-size for a gauge "1" road, and several followers of these notes have asked for a little amplification, wanting to know if the whole issue is literally halved, or only the dimensions. That question is soon settled. The principal dimensions are halved, and the engine otherwise built to the usual measurements for gauge "1." For instance, the frames would be half the given length and depth, with the wheel spacing halved to match; they should be cut from 1/16-in. steel. But as the distance between flange backs on a gauge "1" engine is 1 9/16 in., it is obviously impossible to halve the distance between frames, so they are set 1 5/16 in. apart, which allows for axleboxes with flanges a bare 1/16 in. in thickness. Cast hornblocks are not needed, the horns being cut from 1/16-in. sheet steel, and bent over at the bottom to form the lugs for attachment of the horn-stays. The axleboxes need not have any inside flanges; and a single spring under each, is quite sufficient to carry the load. The wheels should be 1 11/16 in. diameter, on $\frac{1}{4}$-in. axles, the treads being 7/32 in. wide, and the flanges a bare 1/16 in. in thickness and 3/32 in. depth. Coupling rods 5/32 in. with $\frac{1}{4}$-in. bosses running on $\frac{1}{8}$-in. pins. There is no need to bush them when new.

Cylinders should be $\frac{1}{2}$-in. diameter and $\frac{3}{4}$-in. stroke; make the block a little longer than half, say $1\frac{1}{8}$ in., so that $\frac{1}{4}$-in. pistons may be used, and allowance left for 1/64-in. cover spigots and the clearance spaces. Otherwise halve the dimensions; but set the centres a little closer, 11/16 in. instead of $\frac{3}{4}$ in. or you may break through the side of the cylinder block when boring. The bores may, of course, be made smaller if preferred, but the $\frac{1}{2}$-in. bores will give the best results.

(*Continued on page* 246)

*LOCOMOTIVE HEADLAMPS —

By F. C. HAMBLETON

No. 3—Southern Railway Group—S.E. Railway and S.E.C. Railway

NOT only did the L.S.W. Railway in 1878 gain an engineer of great ability in the person of William Adams, but the South Eastern Company likewise in the same year were fortunate enough to engage the services of that very clever designer, James Stirling. His ideas of what a locomotive should be followed closely on those of his famous brother of Doncaster fame, and his design for the headlamps, too, was very similar. Three features, however, distinguished them from brother Pat's. Firstly, the handle (which was semi-circular at the top) was hinged, so that it rested

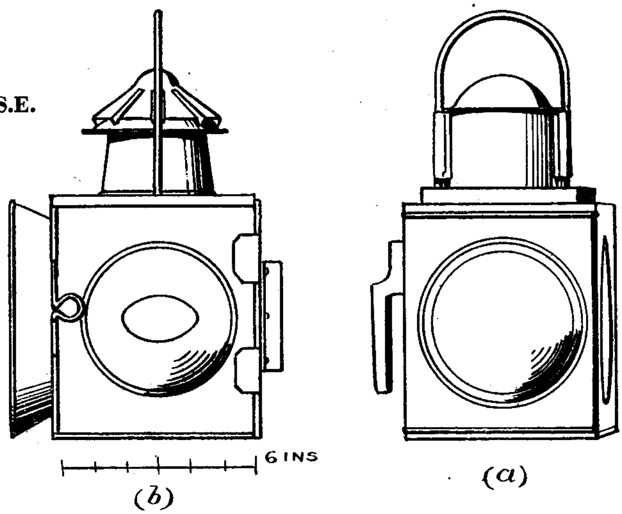


Fig. 2 (a). Early L.S.W. Railway headlamp; (b) Early L.B. & S.C. Railway headlamp.

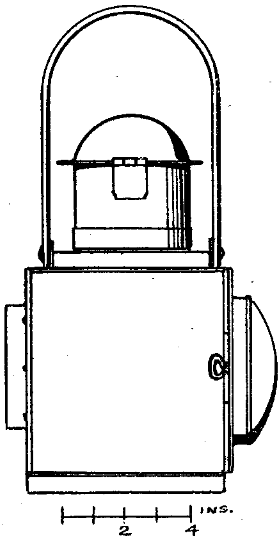


Fig. 1. Stirling headlamp, S.E. Railway.

sideways on the lamp. Secondly, the top was domed, and could be opened for cleaning purposes.

* *Continued from page* 207, "*M.E.*," *February* 26, 1942.

Domes

This domed top resembled that on the early L.S.W. Railway lamps, which also sported a second one attached to the side as a strengthener, Fig. 2. This in turn reminds one of a similar type of lamp used by Stroudley during the period 1870-74 on the L.B.S.C. Railway, Fig. 2 (*b*). The third feature was the Stirling lamp-iron. No one solved better than he the problem of an efficient iron which would support the lamp

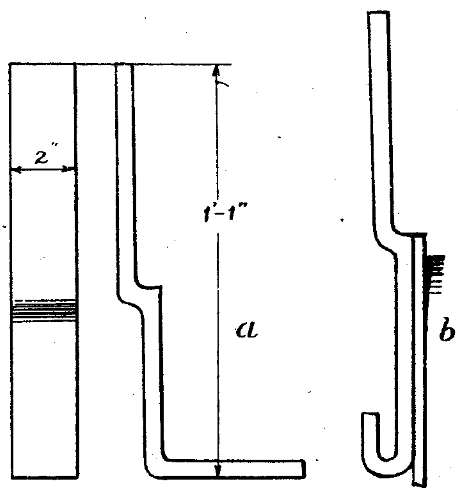


Fig. 3. Lamp-irons, South Eastern Railway.

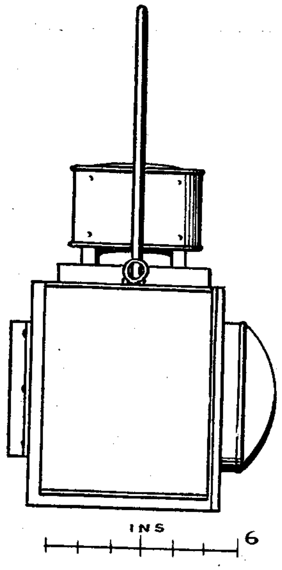


Fig. 4. S.E. & C. Railway headlamp by H. Wainwright.

off the footplate and yet be simple in construction, for it consisted merely of a 2-in. strip with two easy bends in it, the second bend, in the case of the chimney base-iron, forming a convenient hook for an extra headboard, or a special notice, Fig. 3.

The Stirling lamps were painted red, as were those of his successor, Harry Wainwright, who took charge of the L.C.D. Railway and S.E. Railway when they amalgamated under the title of the South Eastern and Chatham Railway in 1899. He retained the Stirling lamp-iron, but slightly modified the lamps by giving them a rigid handle, and the orthodox drum top as previously described on the Adams's lamps, Fig. 4.

Both patterns just described have now vanished, but many of the lamp-irons remain. Incidentally, it will be noticed in Fig. 3 (*b*) how the front plate of the smokebox projected ¾ in. beyond the side-sheet, a peculiarity of Stirling's splendid engines of the S.E. Railway.

(*To be continued*)

"Molly" on Gauge "1"

(*Continued from page* 244)

Use two guide bars only per cylinder; and set these, one on either side of the piston-rod, on the same centre line, using a plain forked crosshead with a groove formed in each side to run on the bars, same as I described for 2½-in. gauge 0-6-0 "Mary Ann." Don't attempt to put four eccentrics between the cranks on this size, the motion would be too fragile; use a pair of loose eccentrics. The middle part of the crank axle may have the two loose tumblers placed on it before assembling, and the drive can either be a sausage-shaped slot in each eccentric engaging with a pin in the crank web next to it, or you can put pins in the sheaves and let the crank cheeks drive them. The rocking-shafts may be left out if you prefer, and the eccentric rods connected direct to the valve spindles, as the angular drive does not adversely affect such a little engine. Steam and exhaust ways need careful drilling between the bores, but otherwise there should be no trouble. A horizontal drum lubricator under the front beam will take care of the oil supply.

I love coal firing, but at the same time am first to admit that firing a gauge "1" tank engine is enough to try the patience of Job himself, for the simple reason that there is no room to manipulate the shovel; so for "Mollyette" I recommend an oil or spirit-fired water-tube boiler. The outer shell should be a little larger than half the size of the loco.-type, say 2-in., and can be made of sheet steel about 1/32 in. thick, brazed up.

The inside barrel should be of 22-gauge copper tube about 1½ in. diameter, with three 5/32-in. water-tubes put in "Averill fashion," that is with the front ends straight. The barrel should be brazed to a copper backhead of 16-gauge material, flanged to the shape of the outer casing. Fittings can be reduced to the minimum. A water gauge is not necessary, and would be too small anyway, for accurate reading in the little cab; and if the safety valves are set to blow off at 80 lb. before fitting, a steam gauge can also be dispensed with. The regulator may be a plain screwdown valve, with a correct type handle for appearance sake, feeding the cylinders *via* a loop superheater. The boiler can be fired either by a small oil burner of the vaporising type, as I have previously described, or by a spirit lamp having six ¼-in. wick tubes made of very thin brass, and fed from a tank in the bunker. Make the side tanks of thin sheet brass, to hold water, which the waste heat from the outer case of the boiler will keep warm, and put a hand pump in one of them, feeding to a clack on the backhead. Anybody requiring further details, just sing out and I will do my best to oblige, circumstances permitting.

Locomotive Cylinder Performance

A reply by G. S. Willoughby to various letters recently published in the "M.E."

Editorial Note: The following remarks have been sent us as a reply to certain recent letters which have appeared in our "Practical Letters" columns. Mr. Willoughby has dealt so fully with several different and most important matters that we have decided to publish his letter as an article, and we trust that it may, at least, calm the fears of any enthusiasts who are prone to resent criticism of the work of great locomotive engineers of the past. It is obvious that famous men like Joseph Beattie, Benjamin Connor, Patrick Stirling, Samuel Johnson, William Adams, or William Dean, did not have the benefit of the knowledge brought to light by the extended researches of G. J. Churchward or, later, A. Chapalon; consequently, the steam locomotive of the past was not, and could not be, so efficient as modern knowledge could have made it. But our models can be designed according to modern ideas, which is the basis of Mr. Willoughby's thesis; he writes:

"I was much interested in the letters of Mr. Kenneth Arnott in your January 8th issue, and also that of the Rev. W. F. Oakley in the January 29th issue, both criticising statements which I made in my article on 'Model Loco. Cylinder and Boiler Design.'

I will deal with the letter of the Rev. W. F. Oakley first. I am afraid that this correspondent has rather misconstrued the purpose of the article in question; which was to point out, among other things, the value of high steam pressures and high cylinder performance, etc., for model locomotives, and definitely not to belittle the work of the old locomotive engineers for whom I have always had the greatest admiration. As a matter of fact, I am more interested in old-time locomotives than in modern ones, and anyone who knows me will bear witness to this.

Many things have been discovered about locomotive design and construction since the Victorian days of locomotive history and because the old locomotive engineers of that period did not know all these things, is no disgrace to them; it is only in line with other forms of engineering which never stand still, but go on improving and become more scientific in design as time goes on. The last word in design of today becomes the commonplace of tomorrow, and the back number of the day after, so to speak. And the purpose of my article was to endeavour to hasten this progress as regards model locomotives.

If I had not admired Victorian locomotives I would never have gone to the considerable trouble of rebuilding the old S.E.R. model loco., of which I am very fond; but that is not to say that I do not realise its shortcomings in design; judged by modern standards of loco. design, it is right out of it.

Although no doubt younger than the Rev. Oakley, I am nevertheless quite old enough to remember intelligently locomotive running in the later 'nineties frequently performed by engines of much earlier date.

Some of the old locomotive engineers were giants of their profession and period, men such as Robert Sinclair, Benjamin Connor, and Joseph Beattie, who were the pioneers of the modern long-lap-and-travel valve gears and to whom I have on several occasions paid tribute in the 'M.E.' in the past; W. Adams, of the North London Railway, the pioneer of high boiler pressure in this country, used 160 lb. steam pressure in 1868 on all his locos.; and also he was the inventor of the Adams bogie; the list could be greatly extended.

But, all the foregoing being true, that is no reason why, if we are modelling old-time locomotives, we should not recognise their shortcomings as viewed from the modern standpoint and changed conditions of working, and incorporate in the models those features of design which are desirable in the light of present-day knowledge. As an instance, I would again mention the last broad gauge 8-ft. single G.W.R. locos. as built by William Dean. Now, I have often wondered what these engines could have accomplished if they had had long-lap-and-travel valve-gear and 30 or 40 lb. higher boiler pressure. But I am *not* belittling William Dean in writing this, as I know perfectly well that Dean was fully aware that the broad gauge was doomed when he brought them out, so he contented himself, quite rightly, with an improved version of the Gooch design engines of many years earlier, just to tide over the few years remaining for the broad-gauge track.

Regarding the last portion of the Rev. Oakley's letter, wherein he states that robust valve gears are required for high steam pressures and long valve travels on model locos., this, of course, is obvious, and if he

will look up the proportions which I have recommended for Stephenson's link motion to suit these features of design, or study the proportions of the valve gear of the "Midge" loco., he will see that ample provision was made for this.

With regard to Mr. Kenneth Arnott's letter, there are some further comments which I would like to make. Referring to the S.E.R. "240" class, the nominal tractive effort with cylinders of 19 in. × 26 in. and 7 ft. wheels, at 75 per cent. of the boiler pressure of 140 lb. per sq. in., was 11,732 lb. Mr. Arnott states that "a large cylinder diameter is bound to be an advantage in starting away especially with 7 ft. wheels.' Quite so, but note this—with cylinders of only 18 in. × 26 in. and 75 per cent. of 180 lb. boiler pressure, the nominal tractive effort becomes 13,538 lb., so that we have a much superior cylinder performance and therefore power in getting away quickly. But again, please don't accuse me of running down the work of James Stirling for mentioning it; I am merely pointing out the more modern method of obtaining power and the value of the higher pressures of steam; incidentally, steam at 180 lb. pressure requires considerably less area from which to rise than steam at 140 lb. —an advantage in a small boiler; so that, thermally, the higher pressure smaller cylinder design is the better. Just the engine to suit the switchback lines in Kent, as Mr. Arnott puts it.

Mr. Arnott makes another statement with which I do not entirely agree; he says that, 'it would seem to be an advantage to over-cylinder a model loco. slightly, if it is used on a non-continuous track in order to give her a chance to "get away" smartly.' To my mind, it should not be necessary to *over*-cylinder a model loco. at all to help it to get away smartly; the cylinders, if they are properly designed and also correctly proportioned to the boiler and worked at a high steam pressure, should be capable of providing all and even more tractive effort than can be fully used in starting and getting away, without any over-cylindering.

The words 'over-cylindering' to me convey a suggestion of an inefficient old-fashoined idea of design; they signify that the engine is not capable of *maintaining* the tractive effort which the size of its cylinders would lead one to suppose was the case. In other words, that the engine was one which would have to be nursed to a greater or lesser degree if it ever had to run on a long continuous track with stiff banks, etc.

Apropos of this, I remember with some amusement that when the 'Midge' was still only on paper it was freely stated in certain quarters that the cylinders were far too small both for rapid starting and maintained power in running with heavy loads. Later on, the writer met the builder of a 'Midge,' and he told a very different story; he said that on perfectly dry rails, with 100 lb. working pressure, the engine would slip violently at starting *with a 15-stone man sitting on the boiler* if the regulator was opened to anywhere approaching the full position (despite the fact that the model weighs at least 2 cwt.), and also that the acceleration with a heavy load was by far the fastest he had ever seen by a model locomotive!

I quite agree with 'Churchwardian' about the success of these S.E.R. locos. as rebuilt by Wainwright with 18-in. cylinders and higher pressure domed boilers, there is no doubt about that. While on this subject, I would also like to mention the last G.N.R. 8-ft. singles of 1894-95 by Patrick Stirling, which had cylinders of $19\frac{1}{2}$ in. × 28 in. In his book, *The British Steam Railway Locomotive*, on pages 294 and 295, Ahrons says this of these engines: 'These engines did good work, though whether they were better than their predecessors with smaller cylinders is doubtful.'

I may add that the predecessors had 18 in. and $18\frac{1}{2}$ in. diameter cylinders by 28 in. stroke.

Now if Ahron's statement is correct, and there would seem to be no reason to doubt its accuracy, it shows that the cylinder performance had, to say the least of it, not been improved by the increase in size; an engine with cylinders of $19\frac{1}{2}$ in. bore should most certainly show a considerable increase of power and performance over one with 18-in. or $18\frac{1}{2}$-in. cylinders. I wonder if these last 8-ft. singles were by any chance over-cylindered. ?

In recent years it has been much more realised than formerly that the cylinders of a locomotive are not the *ultimate* source of power, but only the medium for transmitting the power to the wheels. The ultimate source of power is *the boiler*. The cylinders may be first class in design and of large size, but if the boiler is not able to supply them at all times with all the steam they require and at the proper pressure, then down goes the cylinder horse-power and therefore the cylinder performance.

When an engine is equipped with cylinders of first-class design (with a long-lap-and-travel valve gear to suit) and of a size matching a well-designed boiler which can always give an ample supply of steam at high pressure to these cylinders through large steam pipes, etc., then, high cylinder performance is obtained and with it high r.p.m. if required. That is the modern method."

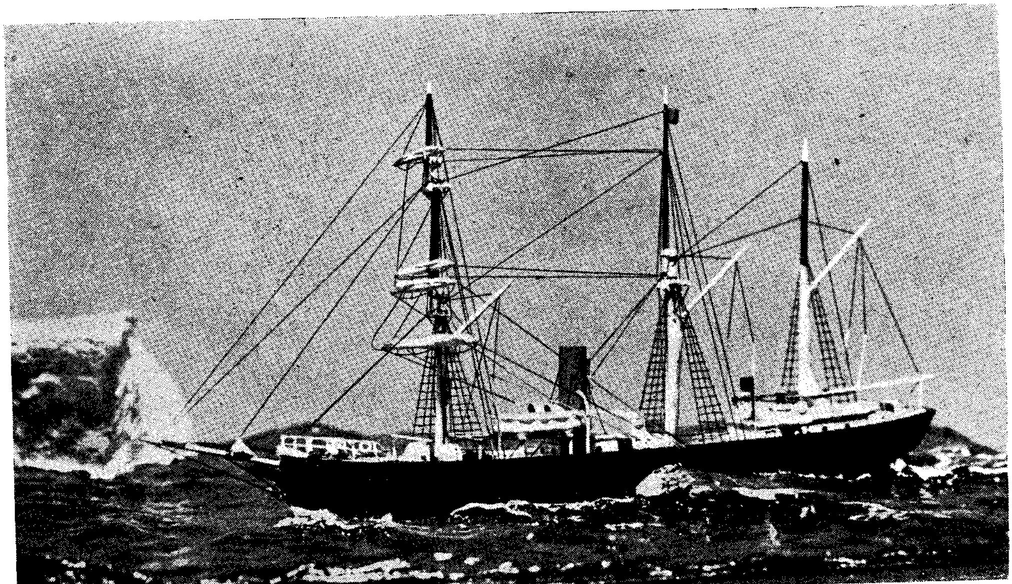
Modelling Antarctic Exploration Ships

A description of four 1 mm. to 1 ft. scale models

By M. EDWIN MOON

SOME few years ago, I met " Jason," the regular contributor to *Ships and Ship Models*, and during the course of conversation he remarked upon the scarcity of models of exploration ships, and in particular of a series of such models. Having always been interested in the Antarctic regions I decided to make a start upon a set comprising those of the 20th century. I spent many months acquiring data, plans, books, photographs and descriptions, and at length began work on a model of Capt. Scott's *Discovery* to a scale of six feet to one inch. In all, I spent three years on her, and she had reached the rigging stage when the blitz put an end to large-scale activities. I needed something smaller, that could be done in odd moments, and would be completed sooner. A miniature seemed to fill the bill, and I decided upon a scale of 1 millimetre to the foot. This obviated a lot of mathematics in working out sizes, as the dimensions in feet from the plans can be translated into millimetres and measured directly from a rule. At the same time, the model is large enough to allow plenty of detail, although it is only some 6 to 7 inches long. A case 8 in. × 8 in. × 12 in. will house it comfortably, yet a collection will not unduly tax the space available in the average house. I also decided to use metal wherever possible, as it is stronger than wood, can be made nearer to scale size, and it is much quicker to build an all-metal mast with its spars than a wooden one. Soldering small metal parts seems to be a bogy to many ship modellers, yet it is, in reality, quite simple and calls for much less " nautical language " than trying to tie and glue tiny spars in position. A methylated-spirit blowlamp, mouth operated, is the best source of heat, while I have found the Rawlplug " 50/50 " solders absolutely ideal. (Usual disclaimer.)

So much by way of introduction; I will now carry on with the description of the construction of a model. As a commencement, *Nimrod* will do very well, as I think she is the simplest of the four that I have made so far. She is a flush-decked barquentine, having only the forecastle raised above the main deck. Her foremast is in three parts, her mainmast is in two, and her



Mr. M. E. Moon's 1 mm. to the foot scale model of the S.Y. " Nimrod."

mizzenmast, in one, so that a detailed description of her construction will also serve for the other three ships.

The principal dimensions of the S.Y. *Nimrod* of the British Antarctic Expedition, 1907-1909, are :—Length on waterline, 136 ft. ; overall, excluding bowsprit, 150 ft. ; beam, 26 ft. 9 in. ; foremast, truck to deck, 78 ft. ; mainmast, truck to deck, 75 ft. ; mizzenmast, truck to deck, 70 ft. ; course yard, 50 ft. ; lower topsail yard, 41 ft. ; upper topsail yard, 39 ft. ; topgallant yard,

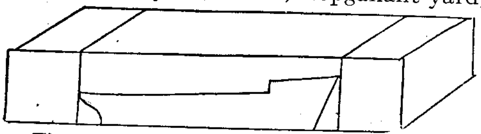


Fig. 1. The marked elevation on block.

30 ft. ; mizzen gaff, 25 ft. ; mizzen boom, 35 ft., and bowsprit, 26 ft. The gross tonnage was 334. She was built at Dundee in 1866.

To begin work, first make a tracing of her deck plan, and also one of the section on the midship line, in which the plain white part of the drawing represents the solid wood part of the hull. Stick the tracing on to thin card, and cut it out carefully. Now obtain a piece of hard white wood. Sycamore is the best, maple is good, so is birch or beech. Satin walnut works well, but pine or deal should be avoided whenever possible on account of its softness and the liability of the grain to show through the paintwork. Carefully plane the block quite smooth and square, as although all these outside surfaces will be cut away, they will help immensely in the shaping-up of the deck if they are true to start with. Now draw a line right down the centre of the deck surface and continue it down the ends and along the bottom, and also draw a couple of lines across the block the length of the deck apart and continue them down the sides. Now place the side elevation template on one side of the block and pencil round it. Transfer it to the other side of the block, taking care to see that the bow is at the same end on both sides, and mark this out also. (Fig. 1).

Now, by making cuts with a fine saw (I find that the miniature hacksaws, taking a 6-in. blade, are ideal for this purpose and many others connected with the job, such as cutting out deck-houses, etc.) downwards to meet the sheer, about ½ in. apart, it will be found quite easy to cut away the waste wood with a sharp chisel, after which the deck may be finished up with a smooth file and glasspaper. When you have obtained a nice flowing curve, free from bumps and hollows, mark on it the outline of the deck and forecastle (Fig. 2) and cut away the waste wood. Cut off the bow rake and the outline of the stern. A little work with a small chisel and the fine file will soon produce the finished hull. The bows should flare outward in a "V" shape, while the stern is of the usual counter shape.

The hull should now be fixed to a baseboard about 1 in. wide, ½ in. thick, and about 12 in. long by means of a couple of screws passed up through the baseboard into the hull. This base should be of the softest wood obtainable, as it has to hold the pins used in rigging the ship. The next things to be made and fixed are the bulwarks and rails. They should be of 1/32-in. plywood if obtainable, failing this, Bristol board will do. Cut a piece about 1 in. wide and rather longer than the hull, and place it so that one edge is level with the bottom of the hull, and then run a pencil along the deck, thus marking out the curve of the sheer. Cut along this curve and smooth it off with fine glasspaper. Now mark in with a pair of compasses another curve parallel with the first and the height of the bulwarks above, and cut off this strip also. Do this for both sides of the hull. Now place another piece of ply or Bristol board flat on the deck, with its end hard up against the end of the forecastle, and run the pencil round on the underside. Lay this piece aside for the present while fixing the bulwarks. The easiest way to do this is to prepare some strips of thin wood, about ¼ in. wide and slightly longer than the beam of the ship. Having glued the lower edge of the bulwark strips and placed them in position on either side of the deck, lay one of the small strips across and push a pin right through into the deck below. Put these strips about 1 in. apart all along the deck. Being small and springy, it will be found easy to adjust the bulwark strips into their correct position, when the hull should be laid aside for the glue to dry. Meanwhile, construct the rail. Take the flat piece with the deck outline marked upon it, and draw in a line on either side of the deck line, and about 1/16 in. away. Cut out the hairpin-shaped result. When the bulwarks have set, this piece must be glued and fixed with the same clamping pieces used for the bulwarks. When the glue has dried, rub the edges down with fine glasspaper until they

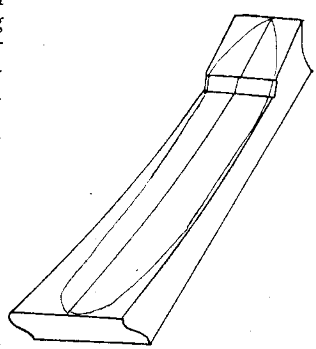
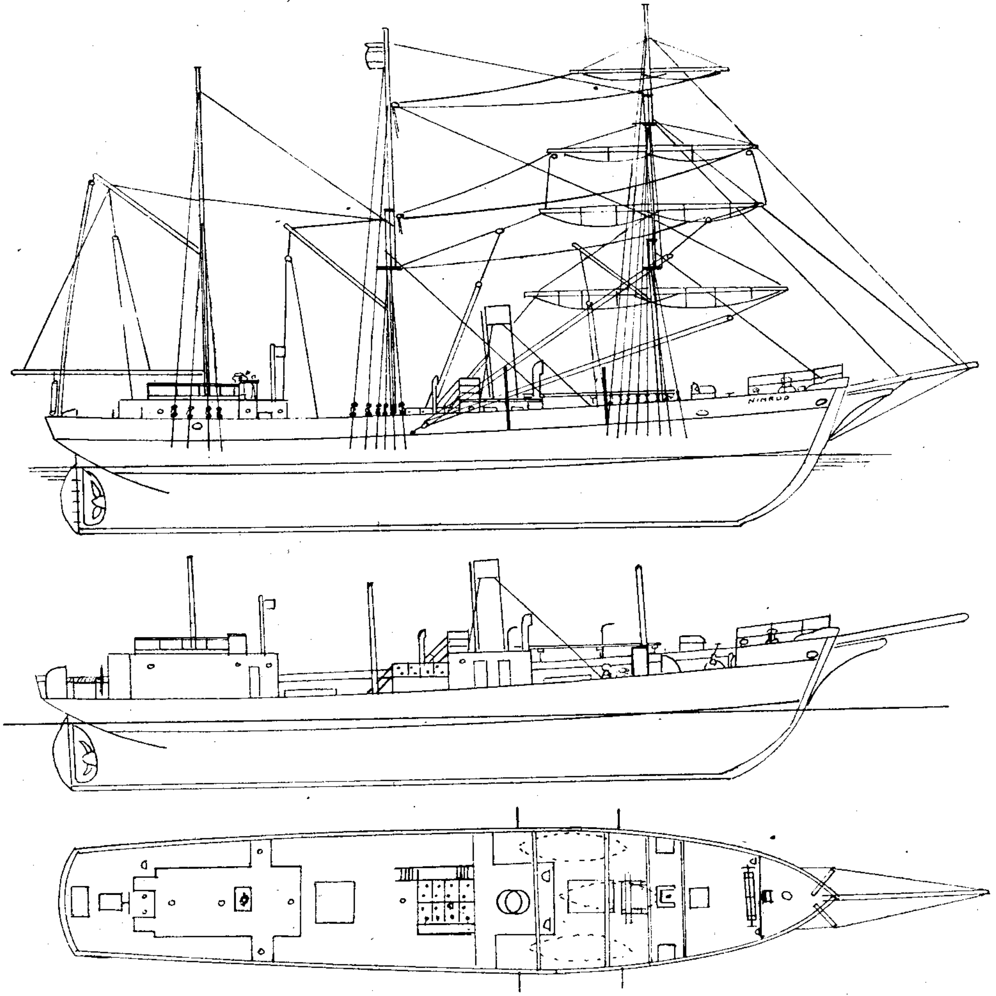


Fig. 2. The sheer carved and deck plan marked.



Three views of the S.Y. "Nimrod," showing rigging and deck fittings.

project about 1/32 in. on either side. Clean up all over with fine glasspaper to a smooth surface, and finish the deck. The best finish for the deck is stain, and a very good one can be made by diluting ordinary Brunswick black, obtainable from the local oil-shop, with turpentine. Rub this in with a piece of rag. If satin walnut is used for the hull a rub over with a drop of linseed oil on a soft rag is all that is needed. These methods give a finish far more resembling a teak deck than any paint ever can, and this is one of the reasons why I prefer sycamore as the wood for the hull.

While this is drying, fix the rail round the forecastle. Make a series of small holes with a darning needle set in a wooden handle all round the forecastle, leaving spaces at the head of the ladders, and glue in the stanchions. These should be made of copper wire, and suitable wire may be purchased in the form of tinned copper fuse wire, in a great variety of sizes, from any good electrical dealer. Dip the ends in glue, and press into the holes. When dry, cut them all off to the same height, adjust them upright, and with a needle, put a small drop of seccotine on the top of each. Slightly moisten a length of silk thread and lay it along the top of the row of stanchions. All the rails on my models, as well as almost all the rigging, are of Pearsall's Gossamer Fly Silk. This is beautiful stuff, fine, strong, and without any trace of "hairiness." Another rail should be fixed halfway down, and when quite dry should be painted white. At the same time, paint the inside of the bulwarks. Do not paint the outside of the

hull yet, as the shrouds, backstays and other rigging have to be stuck on, and the glue will hold better on the bare wood. Run a very narrow strip of paper right along the hull to represent the rubbing strake, and take great care to see that it follows the curve of the sheer, and also glue on a thin piece of wood for the stem post.

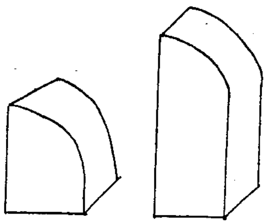


Fig. 3. Companions and heads.

The deck-houses can now be cut out of $\frac{1}{4}$-in. wood and also the companion and "heads." These last may be seen just inside the fore shrouds, and are square in plan with a rounded top. The companion is the same shape, but only about half the height (Fig. 3). Paint white, and mark in the doors with Indian ink and a fine mapping pen. Glue in position. The deck-house roofs are cut out of 1/32-in. ply or Bristol board, and project about $\frac{1}{2}$ mm. all round. They have projections on each side to form the bridge wings. The midship bridge has a canvas dodger round it which extends right across the front of the bridge along the ends and across the back, spaces being left at the tops of the ladders. This dodger is made from thin white notepaper, and is painted a very light grey. The after bridge has a rail round it which goes along the front, ends, and is extended aft along the sides only of the deck-house. Along the bottom of this rail there is a strip of paper about 1 mm. high. This and the stanchions are white, and the top rail is brown in colour. The upper surfaces of these roofs are stained to match the decks and forecastle. At the extreme stern is a wheel shelter made of thin notepaper to the shape of Fig. 4, and immediately in front of this is the wheel, made from a circle of transparent celluloid 4 mm. in diameter and having 10 spokes of thread glued on. The wheel is mounted on a wheel box (Fig. 5), painted white. Portholes are made from thin, green celluloid, punched out with a small punch made by grinding the shank of a broken drill about 3/64 in. diameter off to a flat end. (The colours on a painter's sample card are very useful for this purpose, also for making the side-light screens.) Paint the deck-houses white and put in doors.

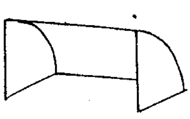


Fig. 4. Wheel shelter.

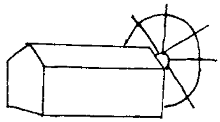


Fig. 5. Wheel and wheel box.

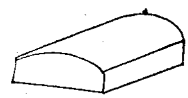


Fig. 6. Hatches.

Hatches are cut from thin wood to the shape shown in Fig. 6, and are black in colour. Boat skids are very fine pins or wire pushed into holes in the deck, with a strip of thin brass soldered across. Davits are made from thin pins or fuse wire.

The boats are shown hollowed out and fitted with oars, thwarts, rudders, etc., although they are only 23 mm. long.

Here's the method. First of all, carve a boat in any hard close-grained wood. I used boxwood. Make a job of it, as you will only want this one, and it will serve for all the models. I know all ship's boats are not the same size, but most people will not notice in this scale, and if you are very particular you can make several sizes.

Make it with stem and stern posts and keel (Fig. 7), and sandpaper it smooth. When you have got it to your liking, get a small rectangular box with a deep lid, or make one out of thin card, and fill it with nice runny plaster of paris. Tap it to expel any air bubbles that may be trapped in the plaster, and then oil the wooden boat all over with a trace of linseed or thin machine oil and press it into the plaster, on its side, so that exactly half of the boat is immersed, and leave it to set. Now, when the plaster is quite hard, make a couple of small dimples in the plaster with a carpenter's countersink, or the tip of a small knife blade. These serve to register the two halves of the mould. Now lightly varnish the upper surface of the plaster with thin shellac varnish. Cut the top out of the lid of the box, so that you have a square with no top or bottom, and place it round the box, to hold the plaster, which you now pour in to form the top of the mould. Leave it for a couple of days to get quite hard and dry, then pull off the cardboard, and carefully separate the two halves of the mould, and take out the wooden pattern.

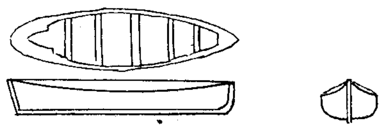


Fig. 7. Boats.

(To be continued)

*Small Capstan Lathe Tools

Notes on "tooling up" for repetition work, with special application to the small capstan attachment recently described in the "M.E."

By "NED"

As in the case of vee-steady tools, there are innumerable varieties of tools which employ roller steadies, and except for the fact that independent adjustment of the roller holders must be provided for, there is much in common in the essential features of the two respective types. The reason why independent adjustment of the rollers is necessary is so that the line of contact of the rollers may, when adjustment is made to suit various diameters, always fall on the true diametral line of the work. In the case of the vee steady, the jaws of the vee make a tangent to the surface of the work, irrespective of its diameter, within the normal range of the tool, and thus adjustment in one plane, at an angle which exactly bisects that of the jaws, is normally sufficient.

The rollers are usually mounted on short rigid pivots, attached to short bars or plates, which are fitted to radial slide ways at the top and back of the work respectively. Some special forms of roller tools have been devised, in which provision is made for moving the roller slides in or out simultaneously, thus affording a "self-centring" motion, but this is a refinement which is hardly necessary in general work; in fact, there are occasions when it becomes desirable to set one of the rollers a little harder on the work than the other when adjusting the tool to produce work exactly to size or to avoid a scratch when it is withdrawn.

It is most important that the rollers should be hardened and finished to a very high polish; the corners should be slightly, but smoothly rounded, so that they cannot dig in and cut the work under any circumstances. They must rotate freely on their pivots, as the slightest friction will impair their proper rolling action, but they must not be so slack that tilting or wobbling can take place.

As in the case of vee steadies, the rollers may be set either in advance of or behind the tool point, and the respective positions produce the same characteristic results. The burnishing effect of the rollers when they are used in the latter position is, however, very useful in commercial work, as it enables a high finish to be maintained, even when the tool has lost its initial keenness or is not meticulously set. Only metals which produce long chips or "curls" can be operated on with roller tools, as short chips or splinters are liable to cling to the rollers and become rolled into the surface of the work, with disastrous effects to the finish. Thus it may be said that mild and free-cutting steels, tough aluminium alloys, copper and certain types of bronzes, nickel alloys, etc., work well with roller tools, whereas cast-iron, and castings in comparatively brittle brass, gun-metal and aluminium alloys, also free-cutting

* *Continued from page* 204, "*M.E.*," *February* 26, 1942.

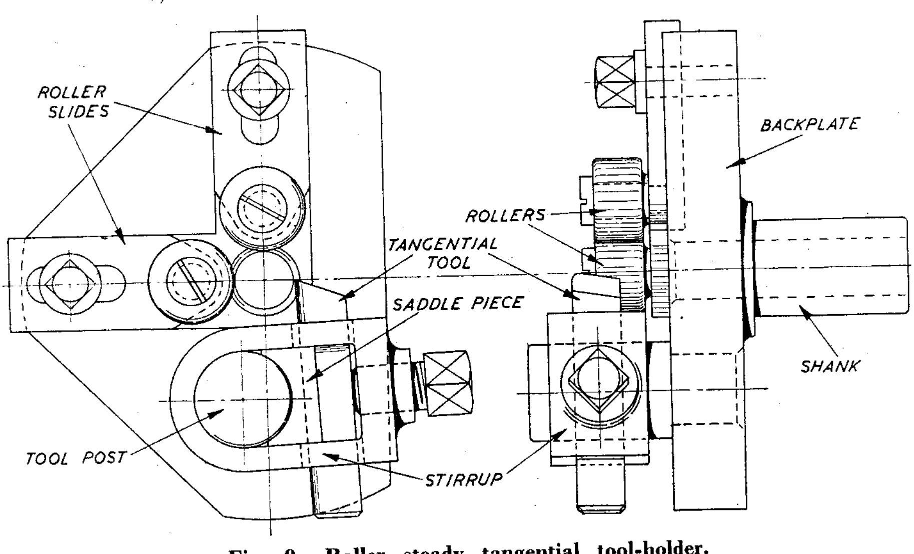


Fig. 9. Roller steady tangential tool-holder.

brass bar or "screw rod" are generally unsuitable. But blind reliance on generalised rules in this respect, or other matters concerning the machining of various metals, is not desirable; the successful tool setter is he who is not afraid to find out for himself, *by actual experience*, the best tool or method of tooling, for a particular material or class of operation.

The roller steady tool illustrated in Fig. 9 embodies at least one feature of interest, which happens to have proved quite successful in the operation to which it was applied. This consists of the use of a tool which is presented tangentially to the work, so that the end face becomes the cutting face, and is the only face which needs regrinding to keep the tool sharp. In this way the actual working life of the tool is much longer than one which is presented to the work in the normal way.

This particular feature was of particular value in the operation to which this tool was applied, because tool wear had proved to be heavy, and resetting frequently required, when using an ordinary tool. The job in question was a light cut over a bar of tough alloy steel, leaving a surface highly finished and accurate to size. As the surface of the raw material was hot rolled, it contained a certain amount of dirt and hard scale, which accounted for heavy tool wear; the chip was also somewhat erratic, and did not clear itself perfectly when a normal form of tool holder was used. The tangential tool proved to be able to penetrate the outer skin and peel off the scale readily, besides throwing the chip clear of the holder, whether it was short or continuous.

In this particular instance the tool steel employed was ¼-in. square section "Toledo" brand, but "Eclipse" steel was also used successfully, and undoubtedly many other well-known brands of high-speed steel would be quite satisfactory. As a radius was required at the end of the cut, a suitable radius was ground on the corner of the tool, throughout its entire length, and thus remained constant when the cutting edge was reground; this, by the way, is another advantage of tangential tools, when any kind of forming operation is to be carried out.

The method of mounting the tool in the holder is of interest, as it provides ready adjustment of the cut, or the height of tool point, with only a single set-screw. It is hardly to be recommended for taking heavy cuts, but no tendency for the tool to slip has so far been observed. A particular feature is that any spring of the tool-post which may possibly take place tends to relieve the cut rather than causing the tool to dig in; this helps to avoid damage either to the work or the tool on the occasions when the cut does not go quite according to schedule.

The tool-post consists of a short cylindrical spigot, ½ in. diameter, turned down to ⅜ in. dia., and fitted to the back-plate by pressing in and riveting. It must, of course, be quite firm and rigid, and brazing or welding may possibly be preferred as a means of ensuring this. A steel stirrup is cut from the solid, having the surface which embraces the spigot made to fit accurately against the latter, and a saddle-piece, shaped equally accurately, is fitted into the gap, with a groove across its flat side to seat the tool. These parts should be case-hardened when finished.

For most operations which involve the use of a square-nosed tool cutting on the front (leading) face, it would be necessary to provide front clearance on the tool; and in order to avoid the necessity of grinding it on this face, the logical thing to do would be to incline the tool forward (in the direction of traverse) at the required clearance angle. This would be quite easy to arrange by cutting the tool slot in the stirrup and the seating groove in the saddle piece a little out of square with the axis of the tool-post.

A certain amount of lateral sliding adjustment of the stirrup on the tool-post is provided, so that the tool point can be set either slightly in advance of or behind the rollers, as required. There is little else in the design of the holder which calls for detailed explanation. It will be seen that the back-plate is made from a circular disc, with the unwanted portions of the edge cut away; this is, in general, a good policy, as any encumbrances to access, vision or chip clearance are best removed, so far as can be done without structural weakening of the holder. The roller slides are let into grooves just sufficiently deep to provide guidance on the true radial line, and held by a single set-screw in each case, the slotted holes in the slides being long enough to provide adjustment to cover the range of diameters of work with which the tool will have to deal.

Tangential tools enable the utmost degree of top-rake to be used without weakening the bit and the clearance angle to be adjusted or varied when setting. High finish often demands using a very fine clearance angle, so that the tool point practically burnishes the work. In some cases the tool is arranged to be fed into the work on the tangential line, i.e. parallel with the length of the tool, or nearly so; in this case the top-rake increases, and the clearance diminishes to zero as the cut progresses, the completion of the operation being a true burnishing action. This method has proved very effective in forming and chasing operations which demand high accuracy and finish.

(*To be continued*)

A Tailstock Feed for Rapid Work

By F. HALL BRAMLEY

A GREAT many small engineering shops are now engaged on small repetition work for armament sub-contracts.

It has been found that for this work a tailstock turret for the engineer's small lathe has offered a means of utilising such a tool for rapid production work from stock bar material fed through the hollow mandrel of the headstock.

In such cases the traverse (or feed up) of the tailstock turret by the conventional tailstock hand-wheel has been found to be slow under some conditions. There is also the important point to be considered that the operator cannot get a good " feel " by hand of the cutting of the tool, since the tailstock barrel screw prevents the reaction to the cutting pressure being adequately felt by the hand operating the wheel.

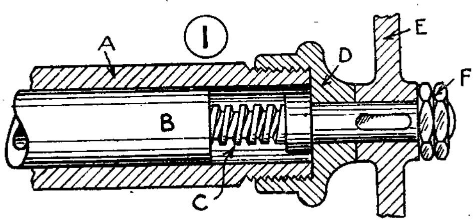


Fig. 1. The conventional traverse arrangements for the barrel of the tailstock.

To overcome these two disadvantages and to increase speed of production, as well as to get better results, the lever arrangement shown in the accompanying drawing has proved very advantageous.

The conventional traverse arrangement for the barrel of the tailstock is shown in Fig. 1, while in Fig. 2 is the proposed alteration in the barrel feed method.

In Fig. 1. *A* is the tailstock main casting, *B* is the sliding barrel, *C* is the left-hand feed screw, *D* is the internally screwed end cap (which also forms an outboard bearing for the feed screw *C*), *E* is the hand-wheel keyed to the feed screw, and *F* the nut and lock-nut allowing of end play adjustment.

In the new arrangement (Fig. 2), those parts which are retained as part of the conventional tailstock are lettered correspondingly to those in Fig. 1.

In this case the feed is by a long lever and the arrangement by means of which this lever feeds or withdraws the tailstock barrel *B*, is set out in side and end views.

The screw *C* (Fig. 1) is substituted by the pull-and-push rod *G*. This is locked to the barrel *B* by its end being threaded to fit the internal square thread in the barrel and secured by the lock-nut *H*. This connection can also be made by reducing the diameter of rod *G* to push in the square thread (being of thread root diameter and having a head at the end to draw up to the left-hand end of

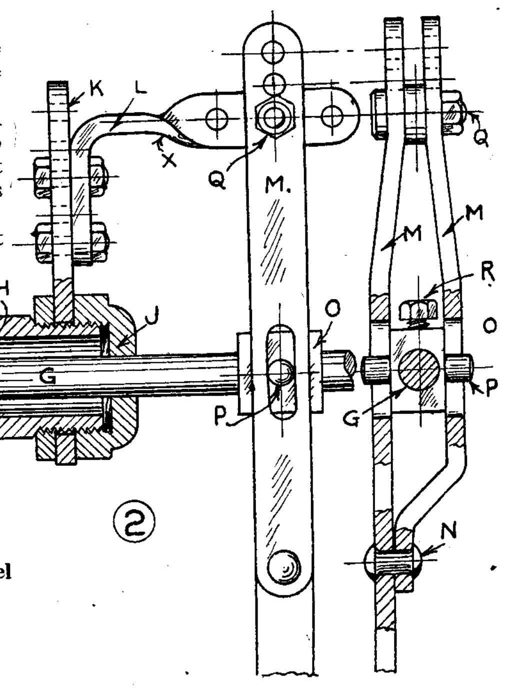
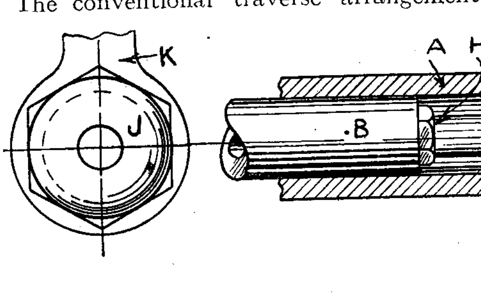



Fig. 2. The proposed alteration in the barrel feed method.

the thread in the barrel and a lock-nut of Whitworth standard at *H* to lock it in the barrel). Where this is possible it eliminates the necessity of cutting a square thread on the rod and a square thread in the lock-nut *H*.

The rod *G* is guided by a new cap *J* to fit the right-hand end of the tailstock. This cap performs a double duty. It acts as a guide for the rod and it is used to clamp the bar *K* (partly shown in the end view at the left). A thin tapped ring or washer is threaded on the tailstock thread and the bar *K* is locked between it and the cap *J*. The hole in bar *K* is a push fit on the top of the threads and does not screw along them.

Attached, by a couple of nuts and bolts, to bar *K* is the bent member *L* of, say, $\frac{3}{4}$-in. by $\frac{3}{8}$-in. mild-steel bar. Several holes are drilled in bar *K* to allow of the adjustment of the member *L* towards or away from the tailstock axial line. The member *L* is heated at *X* and given a quarter turn or twist and its end is drilled with three holes to take a bolt (*Q*) which acts as a fulcrum for the built-up operating lever *M*.

This lever is made of the same bar stock of mild-steel as the member *L* and between the two ends, parallel with each other, the member *L* fits—the bolt *Q*, forming a working joint since the nut locks up to a shoulder on bolt *Q* and does not nip the two arms of lever *M*, but allows freedom of oscillation.

Where the two arms of the operating lever *M* diverge, a space is left for a square block (*O*).

This block is bored through to make a sliding fit on the rod *G* and can be clamped This block (*C*) is provided with two trunnion anywhere along the bar by the set-screw *R*. journals (*P*) in line with each other and formed out of the solid with the block. These trunnion journals (*P*) fit in slots drilled and sawn and filed in the two sides of lever *M*. The top ends of this dual lever are drilled with three holes so as to provide, with the holes in bar *K*, a variable leverage for the operating lever *M*.

The left-hand member of lever *M* (in our illustration) is extended outwardly towards the operator for a convenient distance for handling and appropriate leverage, and the right-hand member is bent down to align with its right-hand face and is riveted to it by the rivet as shown at *N*.

Our view is in plan and the various adjustments provide for getting the most convenient position for operating lever *M* and a slight variation of leverage to suit the job as to length of traverse of the tools in the turret-head on the barrel *B*, and suitable feed pressure on the tools.

In some cases and for some jobs, it may be convenient to use an adjustable stop ring on the rod *G* to limit the forward traverse of the tool, such a ring will be bored to fit the rod and set by a set-screw through the ring, or the ring may be substituted by a slotted clamp with a screw to draw its end tight around the rod.

For the Bookshelf

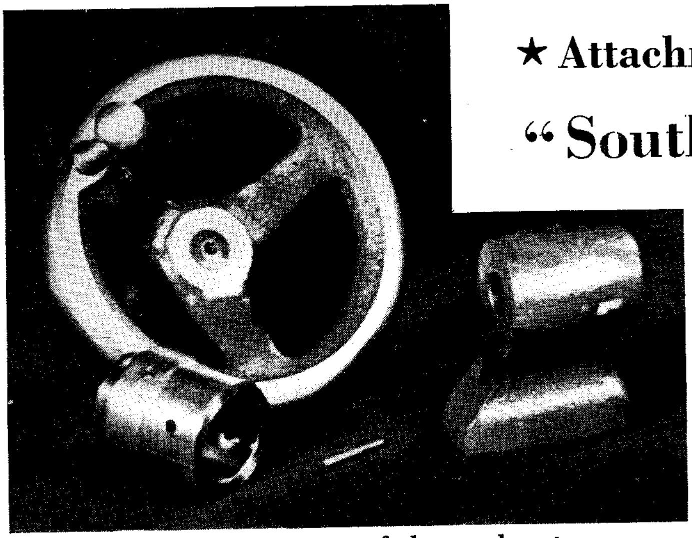
The First Passenger Railway, by Charles E. Lee (London: The Railway Publishing Co. Ltd.); price 5s. 0d. net.

It may come as a surprise to many readers that the railway dealt with in this interesting book is not the Stockton and Darlington Railway, which is usually claimed as the first railway on which passengers were carried. Mr. Lee's claim is for the Oystermouth Railway, or, to give it its later title, the Swansea and Mumbles Railway. Passenger traffic on this humble little line began on March 25th, 1807, and continued until the line was superseded in 1937. The story is well told in this book, the preface to which has been contributed by Mr. Sidney Garcke, who has been closely associated with the "Mumbles Railway" since 1911.

Mr. Lee has evidently spent a considerable time in careful research, not merely for the sake of acquiring information, but to substantiate facts and to present a well-authenticated history. The student of transport will find in these pages much that is engrossing, while many of the numerous illustrations must be unique. The chapters dealing, separately, with the track and the rolling-stock are particularly fascinating to the railway enthusiast, if only on account of the excellent photographs and diagrams included. The book runs to some 90 pages, printed on art paper, and is a welcome addition to railway literature.

The British Journal Photographic Almanack (London: Henry Greenwood & Co. Ltd.) price 2s. 6d. net.

The 1942 edition of this much esteemed handbook is now available, and is as helpful and interesting as ever. Among a number of instructive and informative articles, we would draw special attention to those entitled "Why Not Colour Portraiture?", "At-home Portraiture?", "Creative Table-top Photography," "Ecclesiological Record Work," and "Photographing Ducks." There is the usual review of new goods, and an extensive chapter under the heading of "Epitome of Progress." Last, but by no means least, the quantity of technical information, hints and formulae for every phase of the photographic art is well maintained.



★ Attachments for a "South Bend" Lathe

No. 9. Extra Handwheel and Micrometer to end of Lead-screw

The last of H. S. HOWLETT'S articles in this series

The component parts of the attachment.

MANY makers of small lathes fit a handwheel to the end of the leadscrew as a means of traversing the saddle backwards and forwards along the bed. There are certain jobs which come along from time to time, where a separate handfeed to the saddle is desirous to that of a power feed, and this was found to be so in this case.

The attachment also comes in very handy, and I might say is essential, when cutting racks on the lathe, and when sharpening milling and gearcutters. It was decided while going to the trouble of fitting the handwheel, to incorporate a micrometer collar at the same time, so that accurate measurements of movements of the lathe saddle along the bed could be taken.

A Difficulty Overcome

The first difficulty to crop up, was how to fasten the wheel on to the end of the leadscrew, as the bearing supporting this came practically right to the end of the shaft. On carefully going into the matter with a rule, it was found that by cutting away part of the back bearing boss, thus reducing the bearing in length, but not sufficient enough to cause excessive wear, $\frac{3}{4}$ in. of the leadscrew shaft would be available to fasten the wheel to. I decided to match the existing lathe carriage handwheel, so I removed the taper pin holding this, and the handle, and then got the foundry to build a larger boss on the back of the wheel, so that there would be enough metal for machining purposes. The result was a good clean casting.

The first job was to cut away the surplus metal from the back leadscrew bearing boss. This was mounted on an angle-plate on the faceplate of the lathe, and held securely with a metal clamp across the boss, with the machined face against the top of the angle-plate. Two stops were then bolted to the angle-plate and in contact with the job to prevent any slipping while the boss was being cut away. The bearing hole was then set to run perfectly true, and the metal moved with light cuts till the length of the boss was $1\frac{5}{8}$ in. long.

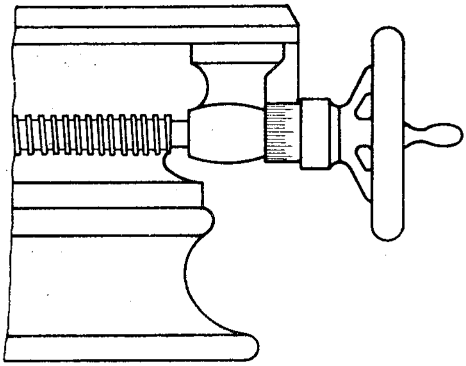
The machined face of the boss was turned conically to the edge of the top face, and the bottom of the tapped hole (which will be broken into) plugged up with lead for appearance sake. The next job was to machine the handwheel casting previously described.

Turning Operation

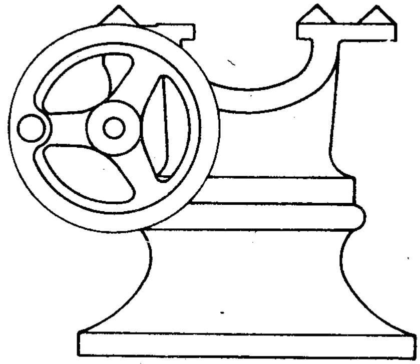
The handwheel was carefully held in the four-jaw chuck, with the jaws inverted, gripping the casting on the rim and setting the boss to run as true as possible, also carefully checking to see that the rim of the casting ran true, as little metal was left on there for machining. The end of the boss was then faced off to length, to the dimensions in the sketch and Slocombed, and the back centre brought up as added support while turning. The boss was then turned to 1 in. diameter $1\frac{1}{2}$ in. from the end, and the edge neatly bevelled off. A drill chuck was then put in the tailstock and a $\frac{1}{4}$-in. drill run truly straight through the centre of the boss; this was then opened out to 7/16 in. and the hole then bored out to $\frac{1}{2}$ in. to be a nice push fit on the end of the leadscrew.

A dummy steel shaft-end was turned and

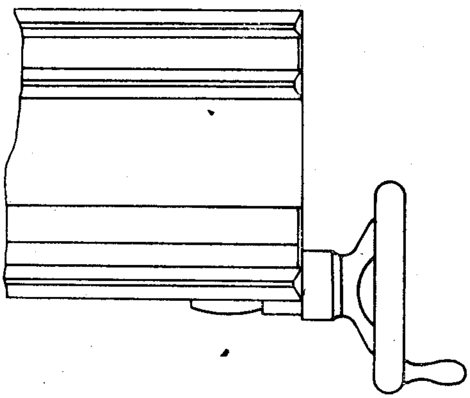
* *Continued from page* 187, "*M.E.,*" *February* 19, 1942.



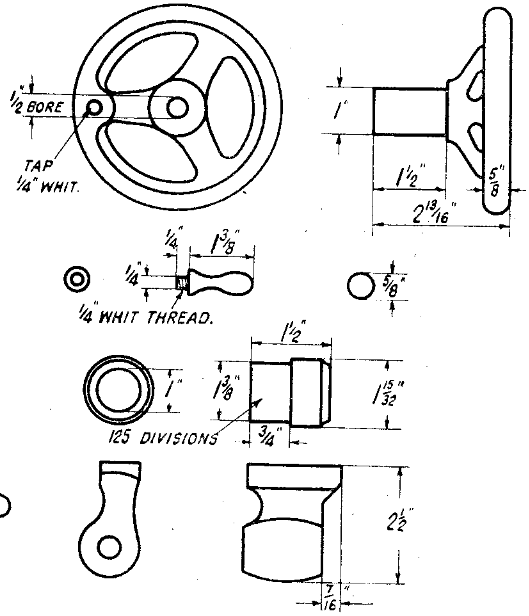
FRONT ELEV^N



END ELEV^N



PLAN



Details.

pressed in position in the centre of the handwheel for appearance. The casting was then taken out, and held by the machined boss in the three-jaw chuck, while the rim was roughed out to a 5/16-in. radius gauge. A radius spring tool was then made, as sketch, and the neck wedged with a piece of hard wood to absorb any chatter that may have occurred. This was carefully fed into the now roughed rim, and left to rub the surface, while the rim revolved to give a good finish before removing.

The boss for the handle was also machined across at this stage and then the centre of the handwheel faced off for neatness.

The steel handle was next turned and threaded, and then the hole drilled and tapped to suit this in the boss on the rim.

The micrometer was turned out of a piece of 1½-in. steel shaft held in the four-jaw chuck and faced across, turned on the outside, Slocombed and drilled straight through and then bored to 1 in. diameter to be a nice sliding fit on the boss of the handwheel. The job was then parted-off, and the 3/16-in. grub-screw hole drilled and tapped.

The hole for the taper pin for fastening the handwheel to the leadscrew was next drilled centrally through both, and then carefully reamered out with a small taper-pin reamer. The taper pin was cut, so that when knocked in position tightly none of the ends protruded beyond the surface.

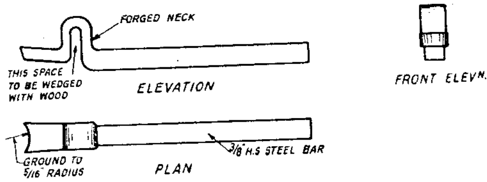
Two holes opposite one another, and in the same position as the taper-pin hole, had to be drilled through the micrometer collar

so that the taper pin could be driven in when the micrometer collar was in position. The leadscrew pitch of the " South Bend " lathe is $\frac{1}{8}$ in., and so a 125-divisions was necessary on the micrometer collar. A dividing wheel with these divisions was not obtainable anywhere, so I had to use the dial indicator, and it proved just as accurate.

Scribing

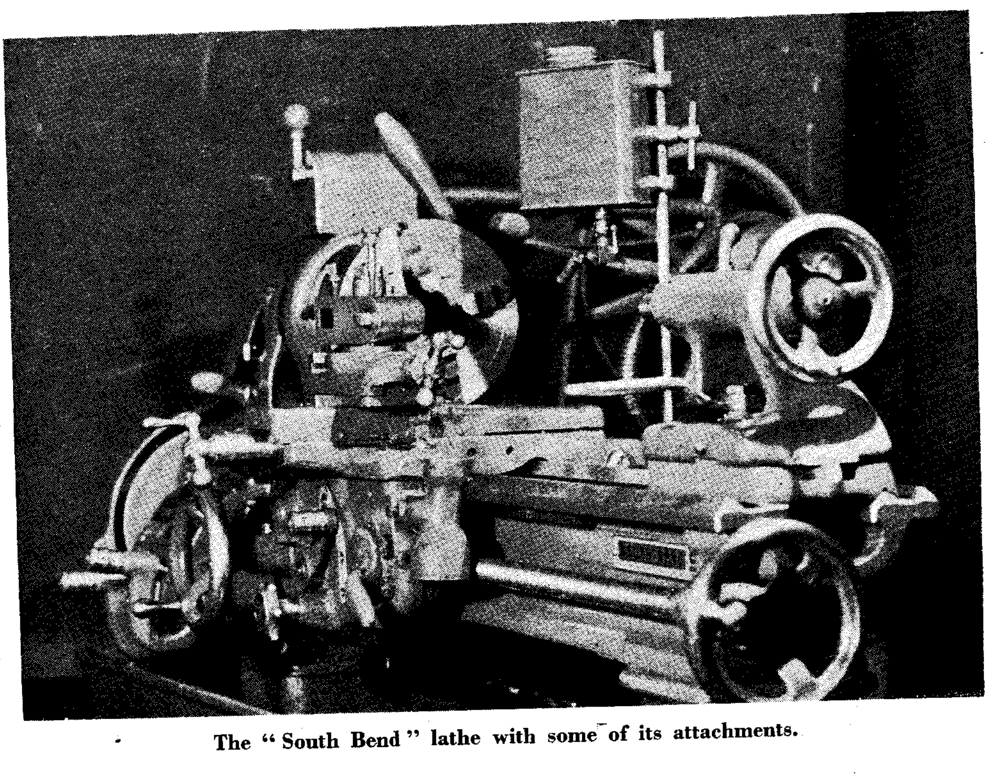
With the handwheel and micrometer assembled on the end of the leadscrew, a piece of plate-glass was put on the bench, beside this, to serve as a scribing table, and a scribing block set to the centre height of the leadscrew, so that the divisions could be scribed on to the collar. The faceplate was then screwed on to the spindle nose and the dial indicator mounted in the lathe tool-post so that the button contacted the face of the faceplate. The lathe clasp nuts were then closed on the lead-screw and the handwheel turned to take all slack out of the nut, to avoid errors creeping in. The top-slide was then adjusted to give a reading on the dial indicator, which was adjusted to zero. The grub-screw was tightened on the micrometer collar, and the first line was scribed across. The handwheel was then very carefully turned to give a thou. reading on the dial indicator and another line scribed. This was repeated 125 times, marking every fifth division with a longer line. When this was completed, all the scribed lines were carefully checked over again.

The collar was taken off the handwheel, set dead true in the four-jaw chuck, and with a screwcutting tool mounted on its side, the scribed divisions were marked deeper and clearer by traversing the tool across and feeding in. Two lines were lightly scribed around the collar so that all the 5th divisions and thou. divisions could finish against these, and look much neater.



Details of the radius spring tool.

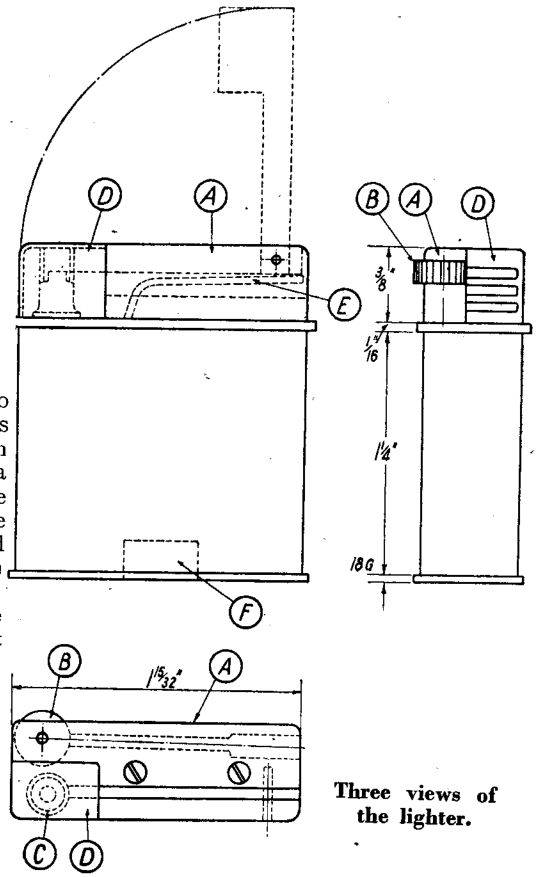
The handwheel and bracket were then given a coat of grey paint to match the lathe. When dry, the whole job was assembled, and a line scribed on the side of the bracket to run into the scribed divisions on the micrometer collar, to enable it to be used.



The " South Bend " lathe with some of its attachments.

How to make a PETROL LIGHTER

A new contributor, Mr. A. HERBERT, deals with a subject of topical interest.



Three views of the lighter.

IT is not claimed that the petrol lighter to be described possesses any special virtues not possessed by the generality of such devices. In point of fact, the whole idea was due solely to a combination of the prevailing shortage of matches and the writer's objection to paying what appeared to be an altogether extortionate price for a lighter.

At the outset, it was intended to utilise such items of lighter "spares" as were at one time readily obtainable at many shops. Protracted inquiry, however, soon made it plain that such "spares" were very much things of the past, and it was, therefore, decided to design a lighter "from the ground up," so to speak. After a good deal of sketching on the backs of envelopes, etc., the general lines were decided upon and a start was made.

A packet of "Ronson" flints was obtained and the dimensions were settled by the size of the hole necessary to pass one of these. At this stage, however, it may be mentioned that if the lighter is to be used with the thicker flints sold for other patterns of lighter, the No. 41 size flint hole must be enlarged to No. 32. No other changes are necessary except that the flint spring will, of course, be wound to suit this larger diameter.

The drawings will no doubt make the construction clear, but a few notes are appended.

The head (A) of the lighter was made from a piece of $1\frac{1}{2}$-in. × $\frac{3}{8}$-in. brass, a piece being sawn off and trued up dead square to $\frac{1}{2}$ in. wide. The next stage was to mark out and drill the No. 50 hole for the wheel pivot and then cut the slot for the wheel. This was actually done with a slitting saw mounted in the lathe, but could be equally well formed by saw, drill and file. After this slot was cut a centre punch was made from an odd bit of 3/32-in. silver-steel and a centre pop made for drilling the flint hole. It is important to cut the wheel slot before doing this, or it will be found that it is extremely difficult to obtain the correct axial alignment of the flint hole.

The flint hole was then drilled right through No. 42 by means of a hand drill, the work being held in the vice and the drill sighted on a line faintly scribed on the top surface of the head. This hole was then opened out to No. 41 and the back end still further opened out No. 38 and tapped $\frac{1}{8}$ in. × 40, and the first few threads drilled out with a No. 29 drill.

The remainder of the operations on the head are quite straightforward and will be seen from the detail drawing of this component (A).

The next item was the wheel. After some experiment it was found that silver-steel was a satisfactory material for this and a length of 5/16-in. diam. silver-steel was truly chucked, leaving about an inch projecting. The end was centred and drilled up No. 50 for 3/16 in. and opened out to No. 49. The extreme end of this hole was very slightly countersunk so as not to do too much violence to the back centre, which was then

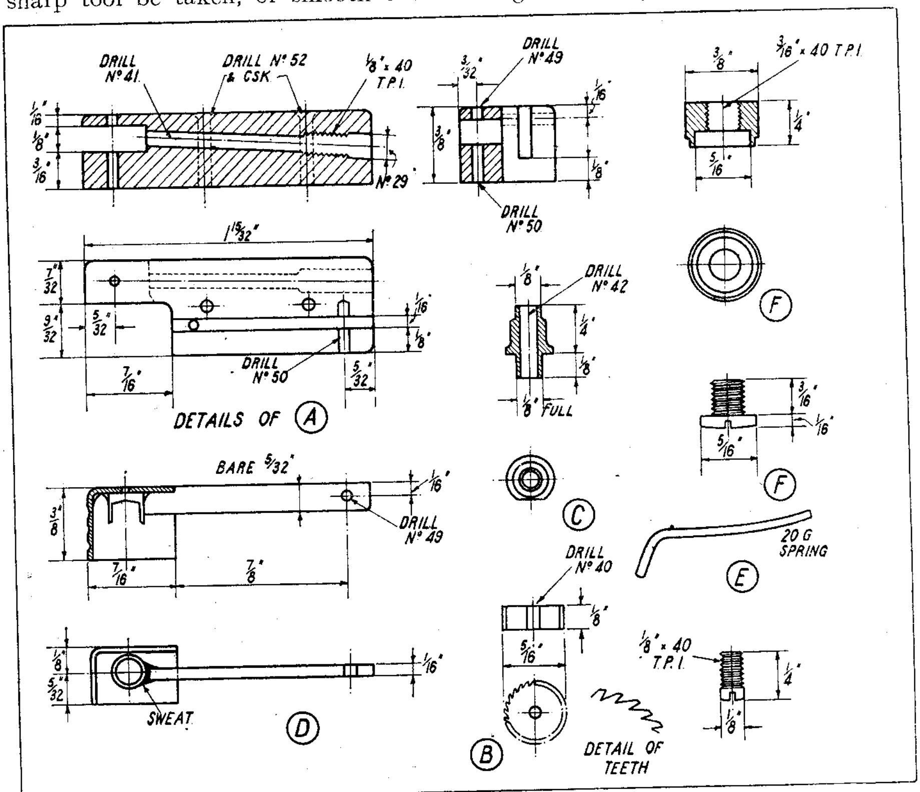
brought up. A narrow parting-tool was then brought into play and a slice $\frac{1}{8}$ in. wide about half parted at the end of the rod.

The next problem was to form the teeth. A tool somewhat resembling a right-hand knife tool with a very acute point was ground up on an old file and laid on its side under the tool-post. A 35-tooth change-wheel was mounted on the tail of the mandrel with a rather rudimentary sort of detent, and the teeth formed by successive traverses of the saddle, moving the mandrel round one tooth of the change-wheel between cuts. It is important that only very light cuts with a very sharp tool be taken, or smooth even

It was found an advantage to form the wheel slot very slightly too short and, after hardening and tempering the wheel, to fit it with the minimum clearance so that the flint can be used right to the very end.

To fit the wheel, the upper hole in the lighter head was opened up with a No. 49 drill and a pin, made from 15-gauge unplated cycle spoke wire, forced home in the No. 50 hole underneath the wheel, taking care to see that the wheel teeth face the correct way.

The flint spring was made from an odd bit of about No. 34-gauge piano wire wound on a suitable mandrel and the ends squared on the grinder, as per "L.B.S.C."



Constructional details of the petrol lighter.

teeth will not be formed. This tooth cutting should be continued until very tiny "lands" not more than about 1/100-in. wide are left between the teeth. The wheel is then parted right off and the burrs removed from the centre hole, after which it is hardened right out and carefully tempered very, very pale straw.

It may be mentioned that, should any reader wish to make several wheels at once, this can be done as rapidly as making one by simply forming 4 or 5 blanks before slotting the teeth, afterwards parting off each finished wheel in turn.

The snuffer and its housing present no difficulty, but some care and wangling will probably be found necessary in soldering up. The sequence of operations in the writer's case was as follows:—The housing was formed from a small flat piece of No. 18-gauge brass sheet filed to fit exactly the rebate in the head. A No. 54 hole was then drilled in it exactly over the position to be occupied by the wick tube.

The sides of the housing were formed from a bit of similar brass carefully bent to exactly complete the rebate in the head. The two components were then held in a cramp

and a fillet of solder run in, after which the housing was cleaned up and the sharp angles arrissed with a fine file to conform to the head.

The snuffer itself was turned up from an odd length of 3/16-in. brass rod and a tiny "tail" formed to just fit the No. 54 hole. The piece was then parted off and the tail inserted and lightly riveted over. This holds the snuffer quite securely whilst the whole assembly is soldered to the arm to which it is attached. During this operation, which is rather tricky and demands some patience, a fillet of solder will flow around the snuffer, allowing the riveted-over portion of the tail to be removed and polished off until quite invisible.

It is not advisable to attempt to fit the snuffer arm in place until it has been thus secured to the snuffer itself, as some little latitude is then available in drilling its pivot hole. Similarly, it is an advantage to leave this arm, which is merely a strip of 16-gauge brass, a trifle longer than necessary, so that the back end can be gradually shortened with a file until it will just swing down into the groove over its spring. If only a trifle too much is taken off this end, the nice sharp snap action of the return spring will be missed.

The return spring itself merely consists of a short length of No. 20 or 22-gauge piano wire bent to shape and inserted in a push-fit hole in the floor of the snuffer arm groove.

The case was bent up around a wooden former from a piece of tinplate, the joint being soldered. The top and bottom were small pieces of 16-gauge brass sheet soldered to the case. It was found a convenience to silver-solder the filler unit into the bottom of the case to avoid the risk of it becoming loose and dropping into the case when the bottom was fitted. The completed case was covered with an ornamental leather by a convenient friend "in the business" and looks quite presentable against the polished brass of the remainder.

The case was filled quite loosely with cotton wool (unmedicated is the best) and a piece of lighter wick about an inch long inserted in the wick tube and trimmed to length with sharp scissors.

In conclusion, it may be said that the lighter not only provided a number of happy hours in its construction, but proved a "first timer" when completed. It has now provided lights for the pipe for several months with complete success and, so far, seems as good as ever.

Letters

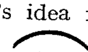
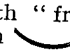
Hull Design

DEAR SIR,—In your issue of January 15th, 1942, Mr. Rose asks how and why a hull with 1 in 24 plane inclination becomes unstable fore and aft. My answer is that *Deanna* would probably "porpoise." Briefly, what happens is this. The front plane, on hitting a wave, is thrown up. This increases the inclination of the rear plane, which follows suit. The front plane then comes down hard on the water and the action is repeated, increasing in amplitude until the hull overturns.

It is an even chance that she would do the same on a perfectly smooth surface.

I gave my theory to account for "porpoising" on smooth water, in a letter which appeared in the "M.E." for August 1st, 1935. It is quite possible to use an inclination of 1 in 24 or steeper if the designer breaks away from the usual as exemplified by *Deanna*. Mr. Rankine has done it and possibly the chief ingredient which contributed to his success was length, beyond the usual, between steps. A photo. of Mr. Suzor's very successful *Nickie V* appears to show a front plane inclination of 1 in 18 and rear plane of much less width, dead flat. If this is correct it proves that a steep plane, stability and high speed can be combined in a hull of moderate length. Such a hull is only arrived at by trial and error.

Regarding the case of a hull with 3 lb. added weight travelling as well as without the 3 lb., I doubt if the unstated minimum of width approached anywhere near the figure given in my letter of November 20th. Even that is not a minimum.

Mr. Rose's idea for a hull with "front step shaped  and the stern " is not fully understood, as the curves may refer to steps in plan or in elevation. I am willing to try anything once if it relates to a speed-boat hull and to publish results, but I must have more details.

As to a hull "tending automatically to ride at the correct height," any plane or system of planes in motion will ride at a certain height out of the water depending on weight, speed and angle of incidence (assuming planes to be flat).

Whilst on the subject of planing surface, it is interesting to note that a slightly concave surface was employed for the rear plane of Sir Malcolm Campbell's *Bluebird II*. My impression is that it was used with a view to decreasing cavitation in a propeller, revolving immediately beneath it at 9,000 revs. or more.

Whether *Deanna* should have two forward additional planing surfaces and one rear or the reverse depends, in theory, on the position of the centre of gravity, of which I am ignorant. In practice, either arrangement may prove to be a failure. The first step in finding out would be to try both arrangements on a towed model. In full-size engineering of a similar nature, this is invariably done.

I will conclude with the hope that Mr. Rose will keep in mind his promise to let me have full particulars of his hull so that I can do some testing for him.

The engine is in process of being bench-tested. Such an interesting power plant as his deserves to be fitted into a hull which has been similarly tested.

Yours truly,

Herstmonceux. J. C. HUDSON.

Gears and Gear Cutting

DEAR SIR,—Referring to Mr. Bradley's reply to my letter published in the February 12th issue, I would comment as follows :—

(1) The diameter of the silver-steel pins is determined by the formula $D = \frac{N \sin \alpha}{D.P.}$

where N = number of teeth in gear,
α = Angle of pressure of teeth,
D.P. = Diametral pitch.

For the 30-tooth 40 D.P. gear under consideration, I deliberately designed for a 20-deg. pressure angle and thus the pins should have been $\frac{30 \sin 20 \text{ deg.}}{40}$ equals 0.2565 in. dia. I admit I did some "wangling" to use $\frac{1}{4}$-in. silver-steel in stock.

This formula appears to agree with the Brown & Sharpe figures if it is assumed they considered a gear of $14\frac{1}{2}$-deg. pressure angle.

$$D = \frac{30 \sin 14\frac{1}{2} \text{ deg.}}{40} = 0.1878 \text{ in.}$$

(2) I agree these forumulae tend to make the teeth tips thin (and sometimes cause interference below the pitch line). I think this is due, however, to considering the centre of the pins on the base circle of the gear. $\frac{(\text{Base circle dia.} = N . \cos \alpha)}{D.P.}$ If a very large tooth be set out accurately on the drawing board—at least as large as 1 D.P. will be required—it will be seen the above tendency can be corrected by placing the pin centres outside the base circle. The smaller the number of teeth in the gear the further out should be the pin centres. Unfortunately, this pin position does not appear to be amenable to simple mathematical analysis and a detailed investigation by means of large-scale diagrams to deduce empirical formulae is rather a formidable task in these days of "War Effort."

It would, of course, not be necessary to investigate for each pitch, as the dimensions are all universely proportioned to the D.P., but for the various numbers of teeth.

Both the pin positions and the depth of cut have been found in my own examples by setting out on the drawing board.

(3) Regarding the effect of the top rake and tilting for front rake, I submit that the error due to these is almost negligible. The greater of the two errors introduced is due to the tilting, and assuming the tilt is 5 deg. then the major axis of the ellipse so produced is $\frac{\cos 5 \text{ deg.}}{1} = 1.0038$ times the pin diameter. It is unlikely an error of at most one-half per cent. matters in a method which is already an approximation.

In connection with the "backing off" problem, the necessary inspiration to apply eccentric turning to a multi-tooth cutter still eludes me and I shall be most interested, in due course, to hear of Mr. Bradley's developments.

My own thoughts have turned to the construction of a multi-toothed cam of a large diameter, rather like a huge ratchet wheel, mounted on the L.H. end of the lathe mandrel and oscillating a universal shaft extending from the change-wheel quadrant to a spring-loaded sliding tool-holder on the cross slide. Some of the parts—but not the cam or sliding tool-holder—have been made for this and it may be finished later.

Meanwhile, every success to Mr. Bradley's developments.

Yours faithfully,

Lincoln. J. RODWAY.

Reminiscences.

DEAR SIR,—I was delighted to read the realistic account of the trip from London Bridge to Epsom by "L.B.S.C." in your issue of February 5th last. As a boy I knew every inch of this road, not only to Epsom, but also to Horsham and thence to Brighton, and I could recall many happy memories of travel down this line, usually behind the then familiar Brighton 4-4-0's. Since then I have renewed my acquaintance with the section he deals with during the past fourteen years, but since the electrification, firstly of the suburban lines, and later of the main lines to the coast, all the interest has gone. I also recall the little Stroudley tank No. 263, together with many others all faithfully recorded in a notebook thirty years back.

Meanwhile, I wish to thank "L.B.S.C." for some very enjoyable reading matter, and the hope of some more to come on the same lines in the near future.

Yours faithfully,

Ewell. M. HARMAN LEWIS.

Backing-off Involute Gear Cutters

DEAR SIR,—The usual automatic relieving gear being usually foreign to the amateur's workshop, a very simple and also accurate method for the relief of gear cutters is to hand in the form of an eccentric mandrel. The mandrel has formed at one end an eccentric portion having about $\frac{3}{8}$-in. eccentricity ($\frac{3}{4}$-in. throw), the diameter of this portion being equal to the bore of the cutter. The cutter is fixed thereto, and a simple indexing fixture fitted so that the cutter can be turned round on the eccentric one tooth at a time. It is essential that the cutter is rigidly clamped to the mandrel at each indexing.

The usual tools which produced the cutter will be used to back it off, the backing-off being done by fixing a length of pipe to the carrier on mandrel, which is worked through a small arc to accomplish the necessary planing action ; meanwhile, the form-tool is fed into the work carefully until the necessary amount of metal has been removed. Each tooth is backed-off separately by this method, and the micrometer dial on cross slide should be used to ensure that each tooth is given equal treatment ; or, alternatively, a stop could be fixed to prevent the slide being advanced above a pre-determined amount.

It should be noted that there is one position of the cutter on the eccentric, and one only, which will be correct for the relieving operation. This can be found quite easily on the drawing board.

I regret that I have not the necessary time to spare to prepare a set of drawings giving the essential details of the method described above. Perhaps some other contributor may care to do so.

Yours faithfully,

Mansfield. J. B. S. POYSER.

Clubs

Malden and District Society of Model Engineers

A lecture on the "Manufacture of Gramophone Records" will be delivered by Mr. L. S. Pinder (of power boat fame) on Saturday, March 21st, 1942, at 3.30 p.m., in the Club-room at 21, Onslow Road, New Malden, Surrey. The lecture will be comprehensive and will be supported with favourite recordings.

An invitation to attend is extended to all model engineers who are engaged on war-work, or who have been evacuated to this district. No pressure will be made on visitors to join this Society, which now has a far larger membership than in pre-war days,

Hon. Sec., (temp.) G. F. TONNSTEIN, 7, Thetford Road, New Malden, Surrey.

The City of Bradford Model Engineers' Society

Future meetings of the above Society are : March 15th, Mr. Ault—Screwcutting ; March 29th, Open Meeting.

Sunday, April 19th, Channing Hall, at 10.30 a.m., Mr. W. D. Hollings will give a lecture on "Pattern-making and Foundry Practice for Model Engineers."

Sunday, May 3rd, Channing Hall, at 10.30 a.m., Open Meeting.

Sunday, May 17th, Channing Hall, at 10.30 a.m., Mr. A. Chubb will give another of his interesting lectures, the subject being "Timekeepers, Ancient and Modern."

Hon. Sec., G. C. ROGERS, 8, Wheatlands Grove, Daisy Hill, Bradford.

The Junior Institution of Engineers

Saturday, 14th March, 1942, at 39, Victoria Street, S.W.1, at 2.30 p.m., Ordinary Meeting. Paper, "Mathematics and Recent Engineering Progress," by S. J. Moore (Assoc. Member and Durham Bursar).

Saturday, 14th March, 1942, at the James Watt Institute, Birmingham, at 2.30 p.m. Midland Section. Ordinary Meeting. Paper by Donald Birch (Member).

The Junior Institution of Engineers are reverting to Friday evening meetings, commencing 27th March, 1942, when Mr. W. Noel-Jordan (Member) will read a paper entitled, "The Modern Motor Cycle," at 6 p.m.

Stephenson Locomotive Society

Upon the resumption of monthly general meetings in London in January last, an informal reminiscent address was given by the President, at 39, Victoria Street, S.W. On February 21st there was a good attendance for a "Do you know ?" afternoon. Members were asked to answer a series of questions on pre- and post-grouping locomotive topics which had been prepared by Messrs. W. H. Whitworth and R. A. H. Weight. Marks were awarded for replies or part replies correctly recorded, and this novel programme for a Headquarter gathering was voted a decided success. Acting Secretary, J. H. SEAFORD, Woodlands Cottage, Fulmer Road, Gerrard's Cross, Bucks.

NOTICES.

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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